

## NEW MACHINE SHAPES UP WAFERS BETTER

*A technology once used to shape optical surfaces now produces flatter, cleaner, and smoother bulk silicon and silicon-on-insulator wafers.*



■ The Precision Wafer Shaper 200 (pictured above), developed by IPEC Precision, Inc. (Bethel, CT), uses plasma-assisted chemical etching to produce ultraflat silicon wafers up to 300 millimeters in diameter.

For microchips to continue getting faster and more powerful, chip designers will need to make transistors smaller and the connecting lines between them thinner. A key lies in finer methods of imaging the circuitry on silicon wafers, a process known as lithography. Current lithographic techniques will be unable to provide the precise imaging needed for future chips, in part because silicon wafers aren't flat enough.

To better prepare for chip fabrication, manufacturers typically use grinding, etching, or polishing processes to smooth out the surface of these wafers, thus removing any microcracks or surface roughness. Unfortunately, many of these chemical and mechanical processes are difficult to control and can result in imperfect wafers.

One solution is high-precision wafer processing equipment developed by IPEC Precision, Inc. (Bethel, CT). This equipment produces smooth, uncontaminated, and undamaged bulk silicon and silicon-on-insulator wafers, and it does it with better control than conventional grinding, chemical/mechanical polishing, and wet chemical etching techniques do. Its precise shaping capability will help solve critical depth-of-focus problems in optical lithography used to fabricate advanced devices with line widths below 0.35 microns.

**Controllable material removal.** At the heart of IPEC Precision's wafer shaping equipment is a novel, patented process called plasma-assisted chemical etching (PACE). In PACE, a plasma-excited reactive gas chemically combines with the surface material to generate a volatile product that is pumped away, removing silicon in highly predictable and controllable quantities. Today, IPEC Precision maintains the rights to more than 30 patents covering many aspects of PACE technology.

Originally conceived and patented by the Perkin-Elmer Corporation, PACE was licensed to Hughes Danbury Optical Systems, which eventually sold the technology and its Precision Material Operations (PMO) group to IPEC. The PMO group was renamed IPEC Precision. BMDO funding helped Perkin-Elmer refine PACE technology for shaping and polishing optical mirrors used in missile tracking systems and high-powered lasers.

"Wafers need to be perfectly flat to allow exposures to be printed for the smaller features and linewidth characteristics of next-generation semiconductors," says Dr. Peter Mumola, IPEC Precision's president. "Our wafer processing equipment creates a flatter surface, which increases the precision with which photolithography can imprint multiple layers of circuit diagrams and reduces wafer defects in the production of advanced semiconductors. This technology opens up the possibility of pushing optical lithography well into the 21st century."

Clearly, PACE technology has made a financial difference in the company's bottom line. "In fiscal year 1997, sales of wafer processing equipment using PACE technology reached \$11 million," says Randy Young, IPEC Precision's marketing director. "Our goal in fiscal year 1998 was to significantly increase this figure through add-on orders from existing customers and customer base expansion." IPEC Precision's customers include virtually all of the major semiconductor manufacturers in the world who, in turn, have sold polished silicon wafers to some of the world's largest chip makers, including Intel and Motorola.

**Next-generation silicon wafers.** MEMC Electronic Materials, Inc. (St. Peters, MO), recently purchased \$5.4 million of IPEC Precision's machines and may buy additional tools for its worldwide semiconductor manufacturing operations. The companies agreed to implement a multiphase, two-year program to develop new tools based on PACE technology for producing future generations of silicon wafers. When the product development is complete, it is anticipated that next-generation silicon wafers will be flatter, cleaner, and smoother than any available today, and will permit MEMC's customers to produce faster, more complex semiconductor devices.

To cement the deal, IPEC and MEMC formed PlasmaSil, a limited liability company owned 60 percent by MEMC and 40 percent by IPEC Precision. PlasmaSil will own all the intellectual property developed under the cooperative development program. The goal of the company will be to license the newly developed technology to IPEC Precision and receive royalties on sales.

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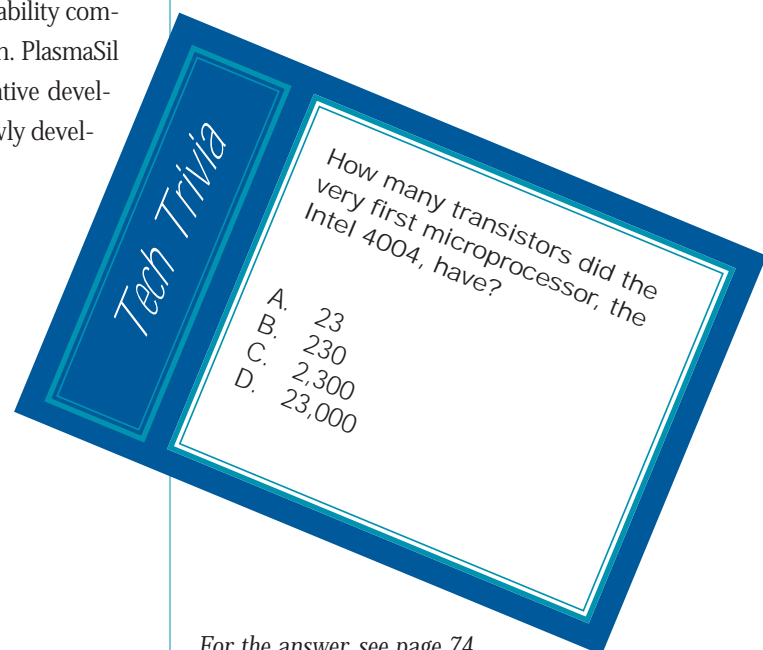
#### What Does It Mean to You?

New processing equipment for ultraflat silicon wafers will improve the quality and lower the cost of microchips, which have worked their way into many consumer electronics, from pagers, video games, and cellular phones to fax machines and personal computers.



#### What Does It Mean to Our Nation?

With major wafer suppliers using better wafer shaping equipment, chip makers such as Intel and Motorola can improve the quality of their products while reducing manufacturing costs.



*For the answer, see page 74.*